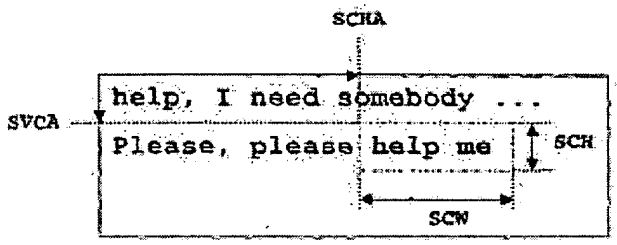
METHOD AND APPARATUS FOR COMPOSITION OF SUBTITLES

Publication number: JP2006506868 (T)
Publication date: 2006-02-23
Inventor(s):
Applicant(s):
Classification:
- international: ***H04N5/278; H04N5/445;*** **H04N5/278; H04N5/445**
- European: H04N5/278
Application number: JP20040552519T 20031103
Priority number(s): EP20020025474 20021115; WO2003EP12261 20031103

Also published as:
WO2004047430 (A1)
ZA200503868 (A)
US2006013563 (A1)
MXPA05005133 (A)
KR20050089005 (A)
more >>

Abstract not available for JP 2006506868 (T)
Abstract of corresponding document: **WO 2004047430 (A1)**

The gist of the invention is a subtitling format encompass-ing elements of enhanced syntax and semantic to provide im-proved animation capabilities. The disclosed elements im-prove subtitle performance without stressing the available subtitle bitrate. This will become essential for authoring content of high-end HDTV subtitles in pre-recorded format, which can be broadcast or stored on high capacity optical media, e.g. the Blue-ray Disc. The invention includes abili-ties for improved authoring possibilities for the content production to animate subtitles. For subtitles that are separate from AV material, the method includes using one or more superimposed subtitle layers, and displaying only a se-lected part of the transferred subtitles at a time. Further, colors of a selected part of the displayed subtitles may be modified, e.g. highlighted.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/047430 A1

(51) International Patent Classification[7]: H04N 5/445, 5/278

(21) International Application Number: PCT/EP2003/012261

(22) International Filing Date: 3 November 2003 (03.11.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02025474.4 15 November 2002 (15.11.2002) EP

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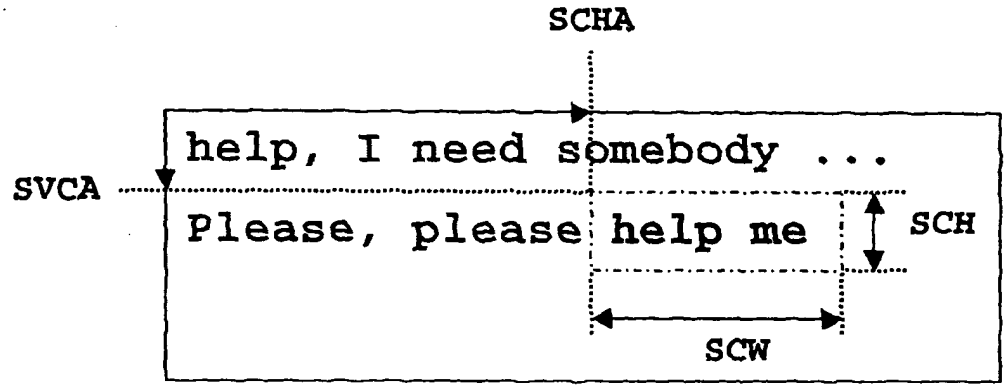
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** METHOD AND APPARATUS FOR COMPOSITION OF SUBTITLES



(57) **Abstract:** The gist of the invention is a subtitling format encompass-ing elements of enhanced syntax and semantic to provide im-proved animation capabilities. The disclosed elements im-prove subtitle performance without stressing the available subtitle bitrate. This will become essential for authoring content of high-end HDTV subtitles in pre-recorded format, which can be broadcast or stored on high capacity optical media, e.g. the Blue-ray Disc. The invention includes abili-ties for improved authoring possibilities for the content production to animate subtitles. For subtitles that are separate from AV material, the method includes using one or more superimposed subtitle layers, and displaying only a se-lected part of the transferred subtitles at a time. Further, colors of a selected part of the displayed subtitles may be modified, e.g. highlighted.

WO 2004/047430 A1

Method and Apparatus for composition of subtitles

The invention relates to a method and to an apparatus for composition of subtitles for audio/video presentations, which can be used e.g. for HDTV subtitles in pre-recorded formats like the so-called Blue-ray Disc.

Background

The technique of subtitling for Audio-Visual (AV) material has been used beginning with the first celluloid cinema movies and further until the recent digital media appeared. The main target of subtitling has been the support of handicapped people or small ethnographic language groups. Therefore subtitling often aims at the presentation of text information even when having been encoded as graphic data like pixel maps. Therefore pre-produced AV material for broadcasting (Closed Caption, Teletext, DVB-Subtitle etc.) and movie discs (DVD Sub-Picture etc.) primarily are optimized for subtitles representing simple static textual information. However, progress in PC software development for presentation and animation of textual information induces a corresponding demand for possibilities and features within the digital subtitling technique used for pre-recording and broadcasting. Using straightforward approaches without any special precautions, these increased requirements for subtitling would consume a too big portion of the limited overall bandwidth. The conflicting requirements for a 'full feature' subtitle encompassing karaoke all through genuine animations are on one hand the coding efficiency and on the other hand the full control for any subtitle author.

For today's state of the art of digitally subtitling AV material with separate subtitling information two main approaches exist: Subtitling can be based on either pixel data

or on character data. In both cases, subtitling schemes comprise a general framework, which for instance deals with the synchronization of subtitling elements along the AV-time axis.

Character data based subtitling:
In the character-based subtitling approach, e.g. in the teletext system ETS 300 706 of European analog or digital TV, strings are described by sequences of letter codes, e.g. ASCII or UNICODE, which intrinsically allows for a very efficient encoding. But from character strings alone, subtitling cannot be converted into a graphical representation to be overlaid over video. For this, the intended character set, font and some font parameters, most notably the font size, must either be coded explicitly within the subtitling bitstream or an implicit assumption must be made about them within a suitably defined subtitling context. Also, any subtitling in this approach is confined to what can be expressed with the letters and symbols of the specific font(s) in use. The DVB Subtitling specification ETS 300 743, in its mode of "character objects", constitutes another state-of-the-art example of character-based subtitling.

Pixel data based subtitling:
In the pixel-based subtitling approach, subtitling frames are conveyed directly in the form of graphical representations by describing them as (typically rectangular) regions of pixel values on the AV screen. Whenever anything is meant to be visible in the subtitling plane superimposed onto video, its pixel values must be encoded and provided in the subtitling bitstream, together with appropriate synchronization info, and hence for the full feature animation of subtitles all pixel changed must be transported. Obviously, when removing any limitations inherent with full feature animations of teletext, the pixel-based approach carries the penalty of a considerably increased bandwidth for the subtitling data. Examples of pixel-based subtitling schemes can

be found in DVD's sub-picture concept "DVD Specification for Read-Only disc", Part 3: Video, as well as in the "pixel object" concept of DVB Subtitling, specified in ETS 300 743.

Invention

The gist of the invention is a subtitling format encompassing elements of enhanced syntax and semantic to provide improved animation capabilities. The disclosed elements improve subtitle performance without stressing the available subtitle bitrate. This will become essential for authoring content of high-end HDTV subtitles in pre-recorded format, which can be broadcast or pressed on high capacity optical media, e.g. the Blue-ray Disc. The invention includes abilities for improved authoring possibilities for the content production to animate subtitles.

Introduced by the disclosure are elements of syntax and semantic describing the color change for parts of graphics to display. This can be used for highlight effects in applications like for example karaoke, avoiding the repeated transfer of pixel data.

Other disclosed elements of syntax and semantic facilitate the ability of cropping parts of the subtitles before displaying them. By using the technique of subsequently transferred cropping parameters for an object to display, a bit saving animation of subtitles becomes available. Such cropping parameter can be used for example to generate text changes by wiping boxes, blinds, scrolling, wipes, checker boxes, etc.

Furthermore the disclosed elements can be used to provide interactivity on textual and graphical information. Especially the positioning and/or color settings of subtitles can be manipulated based upon user request.

Drawings

Exemplary embodiments of the invention are described with reference to the accompanying drawings and tables, which show:

Fig.1: segment_type values for enhanced PCS and RCS;
Fig.2: Enhanced page composition segment;
Fig.3: Enhanced region composition segment;
Fig.4: Example for the definition of a subtitle region and its location within a page;
Fig.5: Example for definition of a region sub-CLUT and region cropping;
Fig.6: Resulting display example;
Fig.7: Interactive usage of subtitles;
Fig.8: Video and Graphics Planes;
Fig.9: Video and Graphics Mixing and Switching.

Exemplary embodiments

The invention can preferably be embodied based on the syntax and semantic of the DVB subtitle specification (DVB-ST). To provide improved capabilities for the manipulation of graphic subtitle elements, the semantics of DVB-ST's page composition segment (PCS) and region composition segment (RCS) are expanded.

DVB_ST uses page composition segments (PCS) to describe the positions of one or more rectangular regions on the display screen. The region composition segments (RCS) are used to define the size of any such rectangular area and identifies the color-lookup-table (CLUT) used within.

The proposed invention keeps backward compatibility with DVB-ST by using different segment_types for the enhanced PCS

and RCS elements, as listed in Fig.1 showing segment type values according to DVB-ST, with additional values for enhanced PCS and enhanced RCS. It would also be possible to choose other values instead. Another approach for keeping backward compatibility would be to keep the existing segment_types and increase the version_number of the specification, e.g. by incrementing the subtitle_stream_id in the PES_data_field structure.

Fig.2. shows the data structure of an enhanced page composition segment (PCS), containing a region_cropping section and a region_sub_CLUT section. Fig.3 shows the data structure of an enhanced region composition segment (RCS), containing an identifier sub_CLUT_id for a sub-color-look-up-table. With respect to original DVB-ST, all structures shown are expanded. In the tables the additional entries are lines 15-28 in Fig.2 and line 16 in Fig.3.
The enhanced PCS shown in Fig.2 carries optional information about the region cropping and optional information about the region_sub-CLUT for every region listed. The two values of region_cropping and region_sub_CLUT indicate if such optional information is available for the current region in process. Therefore cropping and sub-CLUT may be defined separately for every region. While region_cropping is used as a flag, as indicated by "if region_cropping==0x01", the region_sub_CLUT shows the value how many sub-CLUT positions are described. This is done to provide different alternatives within the stream. Alternative sub-CLUT positions can be used to define different menu button positions for the display screen. Only one of them - the first one as a default - is active and the user can change the position to navigate through the different predefined positions pressing the remote for example.

The enhanced RCS shown in Fig.3 carries the sub_CLUT_id identifying the family of CLUTs that applies to this region. This is done to re-use CLUTs for different regions and dif-

ferent region sub_CLUTs as well.
The enhanced PCS and enhanced RCS elements provide the ability that subtitles can be manipulated independent from the encoding method i.e. independent from whether they are encoded as character data or pixel data.

The enhanced PCS and RCS can be used to perform many different animation effects for subtitles. Those could be wiping boxes, blinds, scrolling, wipes, checker boxes, etc. The following figures show an application example for karaoke. Fig.4 shows the definition of a region R containing lyrics of a song displayed for karaoke. The letters of the subtitle may be encoded as pixel data or as character data as well. The region_vertical_address RVA and the region_horizontal_address RHA define the location of the subtitle within the frame, or page PG, to display.

Fig.5 depicts in the upper part region cropping, and in the lower part the location of the region sub-CLUT. Region cropping defines which part of the region is effectively displayed. This is achieved by four parameters RHC,RVC,RCH,RCW indicating the start coordinates and the size of the fragment to display. region_horizontal_cropping RHC specifies the horizontal address of the top left pixel of this cropping, region_vertical_cropping RVC specifies the vertical address of the top line of this cropping, region_cropping_width RCW specifies the horizontal length of this cropping, and region_cropping_height RCH specifies the vertical length of this cropping, wherein cropping means that part of the subtitles that is visible on a display.

The region sub-CLUT location shown in the lower part of Fig.5 defines which part of the region has to be displayed using a color-look-up-table (CLUT) different from the region CLUT. This is achieved by four parameters SCHA,SCVA,SCH,SCW indicating the start coordinates and the size of the sub-region used by the sub-CLUT. All coordinate parameters are

to be understood relative to the region the sub-CLUT belongs to. sub_CLUT_horizontal_address SCHA specifies the horizontal address of the top left pixel of this sub-CLUT, sub_CLUT_vertical_address SCVA specifies the vertical address of the top line of this sub-CLUT, sub_CLUT_width SCW specifies the horizontal length of this sub-CLUT and sub_CLUT_height SCH specifies the vertical length of this sub-CLUT.

Picking up all parameters defined with the previous figures results in the displayed subtitle as depicted in Fig.6. The subtitle is not depicted in whole on the display but only the cropped part of it. Furthermore the sub-CLUT was used to provide a highlight HT, so that the user knows what to sing in the moment.

As the enhanced PCS are sent within MPEG packet elementary stream (PES) packets labeled by presentation time stamps (PTS), any effect can be synchronized to the AV.

Another idea of the invention is the superseding of subtitle animation parameters by the user. This offers a way to realize interactive subtitles. The enhanced PCS parameters are transferred as a default, and the user may change them via a remote control for example. Thus the user is able to move, crop or highlight the subtitle.

This could be an advantage for a user defined repositioning of a subtitling text, so that the user can subjectively minimize the annoyance by the subtitle text placement on top of the motion video. Also the color of the subtitles could be set according to users preferences. Fig.7 shows a block diagram for interactive subtitle modifications. The default parameters DD read from a disc D are superseded by superseding data SD being generated upon the user action UA and processed by a processor P.

Another application for overriding subtitle animation parameters like position, cropping rectangle, CLUTs and sub-CLUTs is the realization of some very basic sort of interactive gaming. The subtitle may carry pixel data of an animated character. This character is subsequently moved on the display screen driven by either user interaction, programmatic control or both.

The overriding of subtitle animation parameters can be implemented in at least two ways. The first option is that the overriding parameters SD replace the parameters DD send in the bitstream. The second option is that the overriding parameters SD are used as an offset that is added to or subtracted from the subtitle animation parameters DD send in the bitstream.

The enhanced PCS and RCS provide a lot more of animation capabilities not explained. Following is a non-exhaustive list of examples: wiping boxes, blinds, scrolling, wipes, checker boxes in details.

Exemplary video and graphics planes are shown in Fig.8 in an exemplary, schematic manner. A background is provided by either an MPEG-2 video layer MVL or a still picture layer SPL. They are mutually exclusive, which means that not both of them need to be held in a buffer at a time. The next two layers comprise a subtitle layer SL and an AV sync type graphics layer AVSGL. These two layers are in this example interchangeable, meaning that either the subtitle layer SL or the AV sync type graphics layer AVSGL may have priority over the other. The front layer is a non-AV sync graphics layer NAVSGL, containing graphics that need not be synchronized with the AV content, such as e.g. menus or other on-screen displays. The inventive method can preferably be used for the subtitle layer SL, the AV sync graphics layer AVSGL and/or the Non-AV sync graphics layer NAVSGL.

Fig.9 shows relevant components of an apparatus for video

and graphics mixing and switching. Data comprising either still picture data or MPEG-2 video data, further data for subtitles, data for animations and data for non-AV sync graphics such as menu buttons, are retrieved from a disc D. Additionally or alternatively, data for subtitles, animations and/or non-AV sync graphics can be received from a network NW, e.g. internet. A processing unit CPU processes the non-AV sync graphics data and sends the resulting data to a rendering device for non-AV sync graphics RNAVG.

The apparatus contains a still picture decoder SPDec and an MPEG-2 video decoder MVDec, but since only one of them is used at a time, a switch s1 can select which data shall be used for further processing. Moreover, two identical decoders AVSGDec1,AVSGDec2 are used for decoding subtitle and animation data. The outputs of these two decoders AVSGDec1, AVSGDec2 may be switched by independent switches s2,s3 to either a mixer MX, or for preprocessing to a mixer and scaler MXS, which outputs its resulting data to said mixer MX. These two units MX,MXS are used to perform the superimposing of its various input data, thus controlling the display order of the layers. The mixer MX has inputs for a front layer f2, a middle front layer mf, a middle back layer mb and a background layer b2. The front layer f2 may be unused, if the corresponding switch s3 is in a position to connect the second AV sync graphics decoder AVSGDec2 to the mixer and scaler MXS. This unit MXS has inputs for front layer f1, middle layer m and background layer b. It superimposes these data correspondingly and sends the resulting picture data to the background input b2 of the mixer MX. Thus, these data represent e.g. a frame comprising up to three layers of picture and subtitles, which can be scaled and moved together within the final picture. The background input b1 of the mixer and scaler MXS is connected to the switch s1 mentioned above, so that the background can be generated from a still picture or an MPEG-2 video.

The output of the first AV sync graphics decoder AVSGDec1 is connected to a second switch s2, which may switch it to the middle layer input m of the mixer and scaler MXS or to the middle back layer input mb of the mixer MX. The output of the second AV sync graphics decoder AVSGDec2 is connected to a third switch s3, which may switch it to the front layer input f1 of the mixer and scaler MXS or to the middle front layer input mf of the mixer MX.

Depending on the positions of the second and third switch s2,s3, either the output of the first or the second AV sync graphics decoder AVSGDec1,AVSGD2 may have priority over the other, as described above. For having the data from the first decoder AVSGDec1 in the foreground, the second switch s2 may route the subtitle data to the middle back input mb of the mixer MX, while the third switch s3 routes the animation graphics data to the front input f1 of the mixer and scaler MXS, so that it ends up at the background input b2 of the mixer MX. Otherwise, for having the data from the second decoder AVSGDec2 in the foreground, the switches s2,s3 may route their outputs to the same unit, either the mixer and scaler MXS or the mixer MX, as shown in Fig.9.

Claims

1. Method for composition of subtitles for audio/video presentations, wherein subtitle information is separate from audio/video material, and subtitle information is transferred from a network or a storage medium, such as a disc, **characterized in**
   - using one or more subtitle layers; and
   - cropping parts of the subtitles of a layer or layers before displaying them, so that only a selected (RHC,RVC,RCH,RCW) part of the transferred subtitles is displayed at a time.

2. Method according to claim 1, wherein the colors of a specified (SCHA,SCVA,SCH,SCW) part of the subtitles may be modified.

3. Method according to claim 1 or 2, wherein subtitles may be interactively moved, cropped or highlighted, or the colors of subtitles be interactively modified by a user.

4. Method according to any of the previous claims, wherein the subtitles may contain graphics.

5. Method according to any of the previous claims, wherein the AV material and the subtitles comply with the DVB-ST standard.

6. Apparatus for composition of subtitles, the apparatus mixing and switching video and graphics data, the data being read from a storage medium or received from a network and comprising still picture data or MPEG video data, data for at least two layers of subtitles or animations, and optionally data for non-synchronized graphics, the apparatus comprising
   - a mixer (MX) that may superimpose video data of a

back layer, at least two middle layers and a front layer;

- a mixer and scaler (MXS) that may superimpose video data of a back layer, a middle layer and a front layer, the mixer and scaler (MXS) providing its output data to the mixer (MX);
- a video decoder (MVDec) and/or a still picture decoder (SPDec), wherein the output data of either the video decoder or the still picture decoder may be switched (s1) to the mixer and scaler (MXS);
- at least two simultaneously working decoders (AVSGDec1,AVSGDec2) for synchronized graphics or subtitles, wherein the output of each of the decoders may be switched (s2,s3) to either the mixer (MX) or the mixer and scaler (MXS), and wherein a decoder (AVSGDec1,AVSGDec2) may select a part (RHC,RVC,RCH,RCW) of its input data to be output for display;
- a renderer for the non-synchronized graphics, providing data to the mixer (MX).

7. Apparatus according to claim 6, wherein a decoder (AVSGDec1,AVSGDec2) may apply a different color-look-up table to a specified (SCHA,SCVA,SCH,SCW) part of a subtitle layer.

8. Apparatus according to claim 6 or 7, comprising a subtitle decoder (ST-DEC) that is capable of superseding default subtitle parameters (DD) with other subtitle parameters (SD) generated upon user action, for interactively modifying or highlighting subtitles.

9. Apparatus according to any of claims 6-8, wherein the data comply with the DVB-ST standard.

0x10	page composition segment	defined in 7.2.1
0x11	region composition segment	defined in 7.2.2
0x12	CLUT definition segment	defined in 7.2.3
0x13	object data segment	defined in 7.2.4
0x14	enhanced page composition segment	defined here
0x15	enhanced region composition segment	defined here
0x40 - 0x7F	reserved for future use	
0x80	end of display set segment	defined in 7.2.5
0x81 - 0xEF	private data	
0xFF	stuffing	
All other values	reserved for future use	

Fig. 1

Line	Syntax	Size	Type
1	page_composition_segment () {		
2	sync_byte	8	bslbf
3	segment_type	8	bslbf
4	page_id	16	bslbf
5	segment_length	16	uimsbf
6	page_time_out	8	uimsbf
7	page_version_number	4	uimsbf
8	page_state	2	bslbf
9	reserved	2	bslbf
10	while (processed_length < segment_length) {		
11	region_id	8	bslbf
12	reserved	8	bslbf
13	region_horizontal_address	16	uimsbf
14	region_vertical_address	16	uimsbf
15	region_cropping	8	bslbf
16	if (region_cropping == '0x01') {		
17	region_horizontal_cropping	16	uimsbf
18	region_vertical_cropping	16	uimsbf
19	region_cropping_width	16	uimsbf
20	region_cropping_height	16	uimsbf
21	}		
22	region_sub_CLUT	8	uimsbf
23	for (i=0; i < region_sub_CLUT; i++) {		
24	sub_CLUT_horizontal_address	16	uimsbf
25	sub_CLUT_vertical_address	16	uimsbf
26	sub_CLUT_width	16	uimsbf
27	sub_CLUT_height	16	uimsbf
28	}		
29	}		
30	}		

Fig. 2

Line	Syntax	Size	Type
1	region_composition_segment () {		
2	sync_byte	8	bslbf
3	segment_type	8	bslbf
4	page_id	16	bslbf
5	segment_length	16	uimsbf
6	region_id	8	uimsbf
7	region_version_number	4	uimsbf
8	region_fill_flag	1	bslbf
9	reserved	3	bslbf
10	region_width	16	uimsbf
11	region_height	16	uimsbf
12	region_level_of_compatibility	3	bslbf
13	region_depth	3	bslbf
14	reserved	2	bslbf
15	CLUT_id	8	bslbf
16	sub_CLUT_id	8	bslbf
17	region_8-bit_pixel-code	8	bslbf
18	region_4-bit_pixel-code	4	bslbf
19	region_2-bit_pixel-code	2	bslbf
20	reserved	2	bslbf
21	while (processed_length < segment_length) {		
22	region_id	8	bslbf
23	[...]		
24	}		
25	}		

Fig. 3

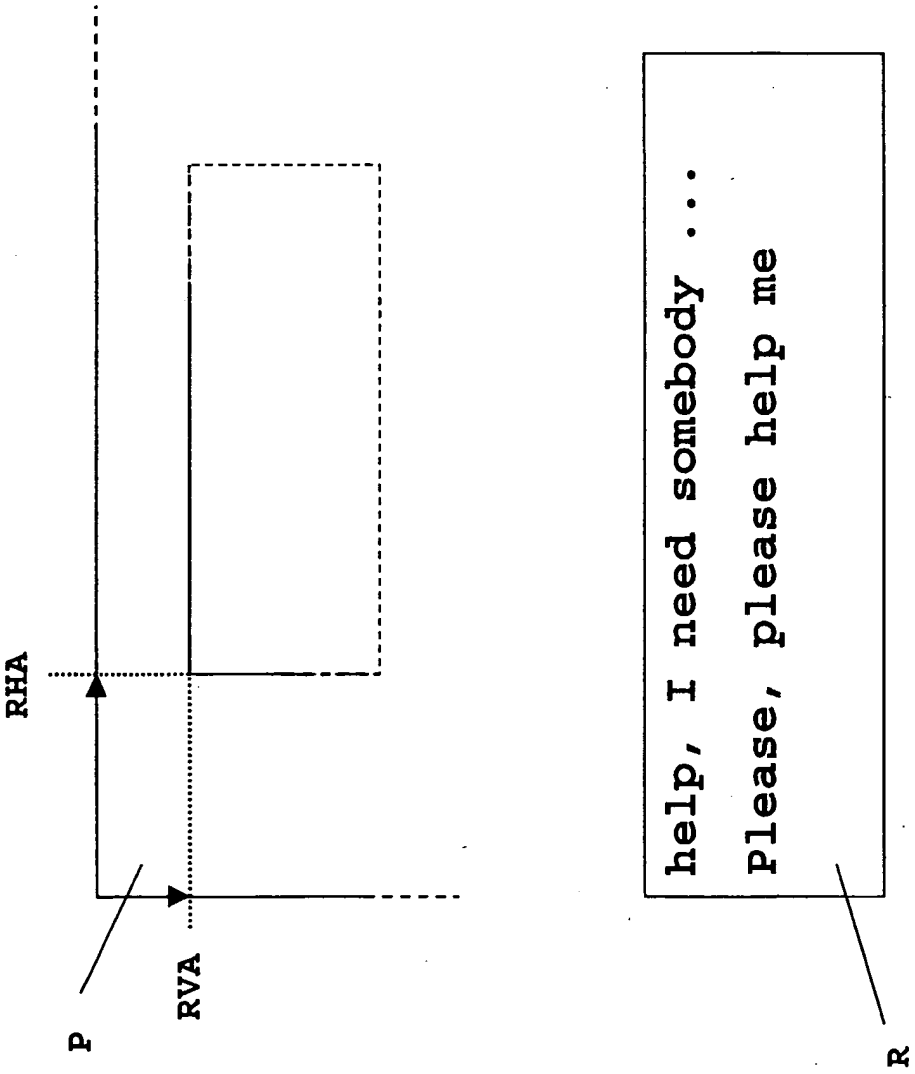


Fig. 4

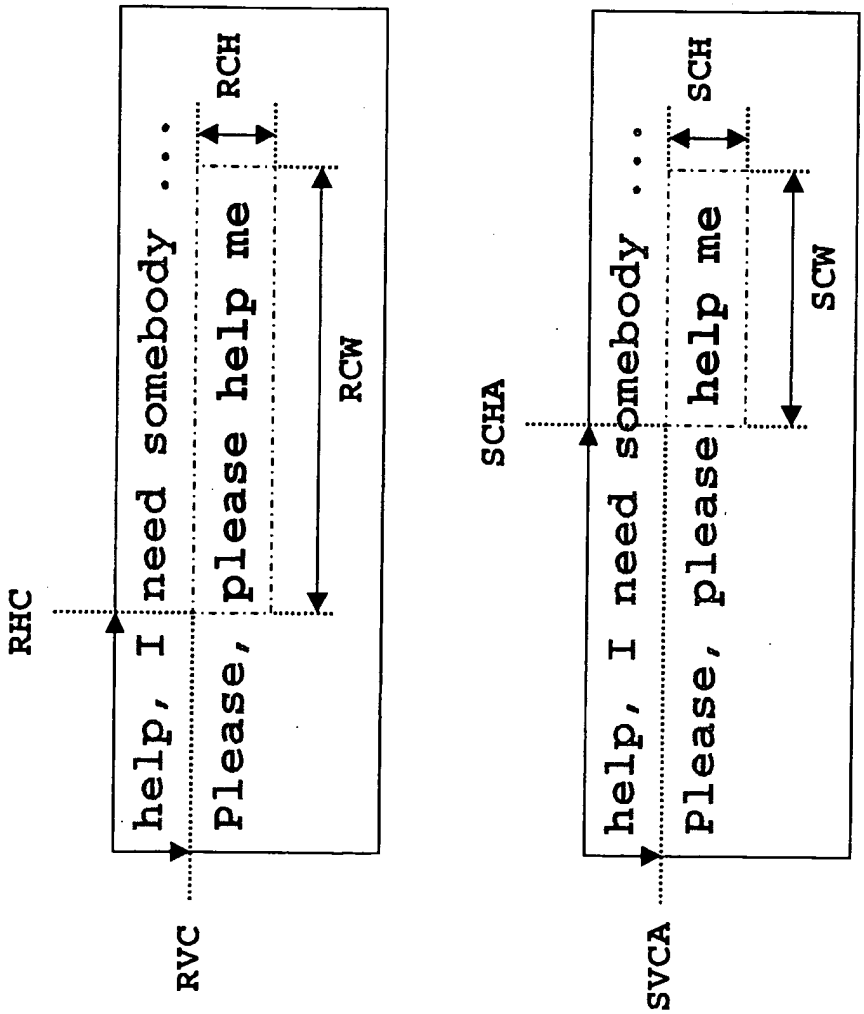

RHC
RVC
help, I need somebody ...
Please, please help me
RCH
RCW
SCHA
SVCA
help, I need somebody ...
Please, please help me
SCH
SCW

Fig. 5

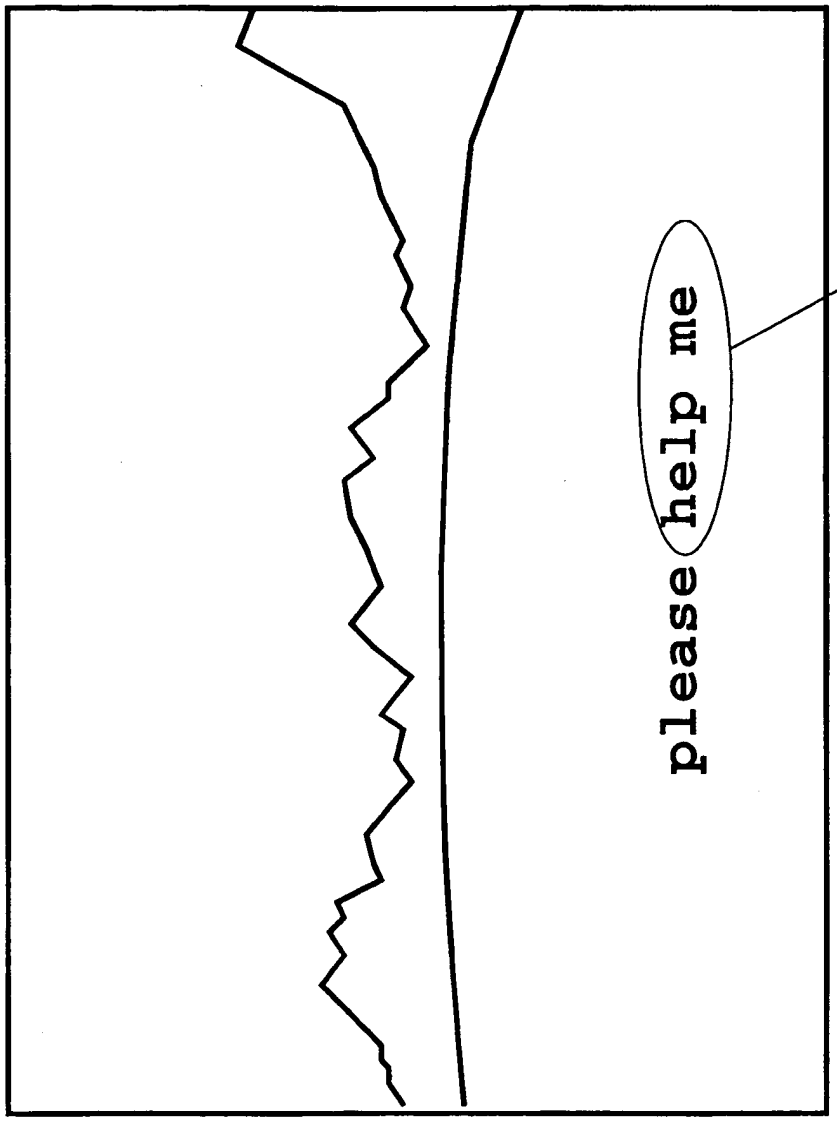


Fig. 6

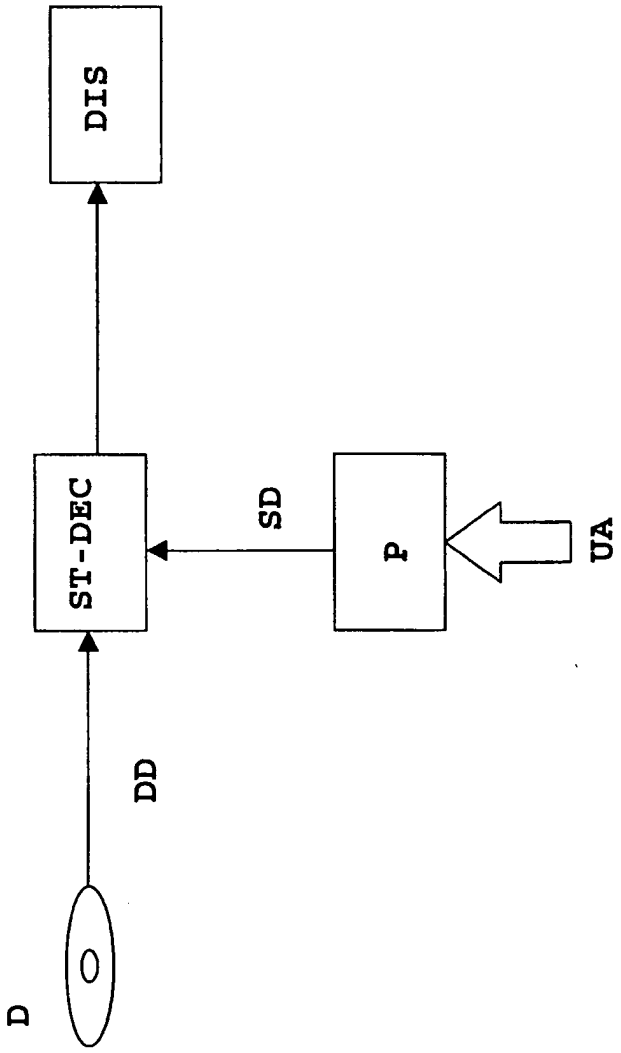
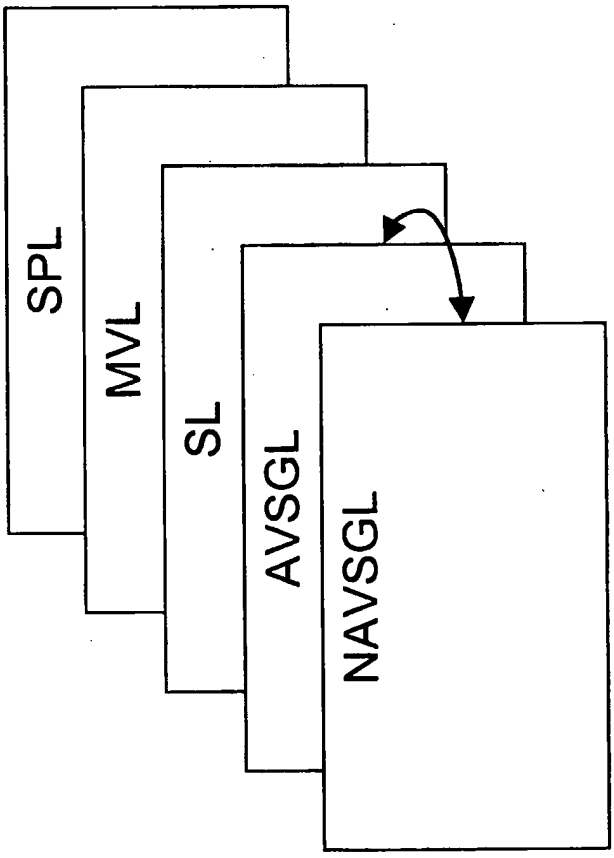


Fig. 7

Fig.8



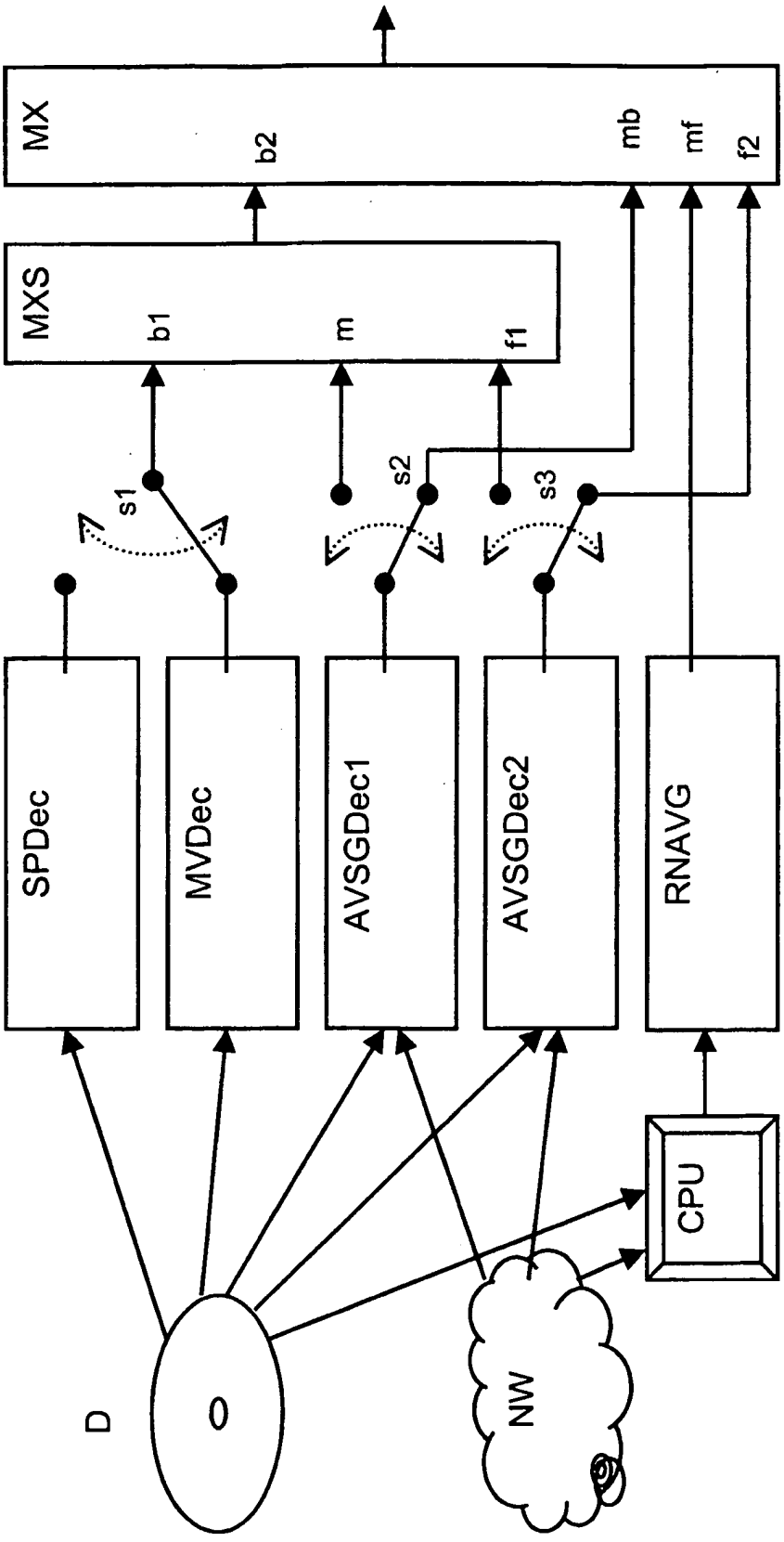

MX
b2
mb
mf
f2
MXS
b1
m
f1
s1
s2
s3
SPDec
MVDec
AVSGDec1
AVSGDec2
RNAVG
CPU
D
0
NW

Fig. 9

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/12261

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/445 H04N5/278

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 09, 31 July 1998 (1998-07-31) & JP 10 108129 A (KENWOOD CORP), 24 April 1998 (1998-04-24) abstract	1,3,6
A	US 2002/063681 A1 (CHEN MILTON ET AL) 30 May 2002 (2002-05-30) abstract paragraph '0021! - paragraph '0025!; figure 2 paragraph '0030! - paragraph '0037!; figure 5	1,6

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 February 2004	26/02/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fuchs, P

INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 8 317301 A (HITACHI LTD), 29 November 1996 (1996-11-29) abstract -----	1,3,6

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 03/12261

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 10108129 A	24-04-1998	NONE	
US 2002063681 A1	30-05-2002	TW 505866 B	11-10-2002
JP 8317301 A	29-11-1996	NONE	